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GENERAL RESISTANCE, INC.

DAS SERIES
40/50/60/70/80

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INSTRUCTION MANUAL
DIAL-A-SOURCE

DAS SERIES

40, 50, 60, 70, AND 80.

GENERAL RESISTANCE, INC

75 Haven Avenue
Mt. Vernon, New York 10553

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NOTE: From time to time, new applications for DAS Series instruments are discovered. Many of them are of general interest. If you would like to be placed on a special mailing list to receive these Application Notes, please write us on your company letterhead, including department and mail stop if necessary. Just ask for "DAS APPLICATION NOTES".

Naturally, if you have found any new applications, we would be extremely interested in hearing about them.

WARRANTY

General Resistance, Inc. warrants each instrument to be free from defects in material and workmanship for a period of one year from date of purchase.

The obligation of General Resistance, Inc. under this Warranty is limited to servicing or adjusting any failed instrument returned, shipped prepaid, to the factory for that purpose.

Units returned under this warranty shall be examined by General Resistance, Inc. to establish that the failure resulted from defective material and/or workmanship and not as a result of improper operation, which failure is not within the meaning of this Warranty.

General Resistance, Inc. reserves the right to make changes to design at any time without incurring any obligation to install same in units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of General Resistance, Inc., and General Resistance, Inc. neither assumes nor authorizes any person to assume for them any other liability in connection with the sale of General Resistance, Inc. products.

Figure A

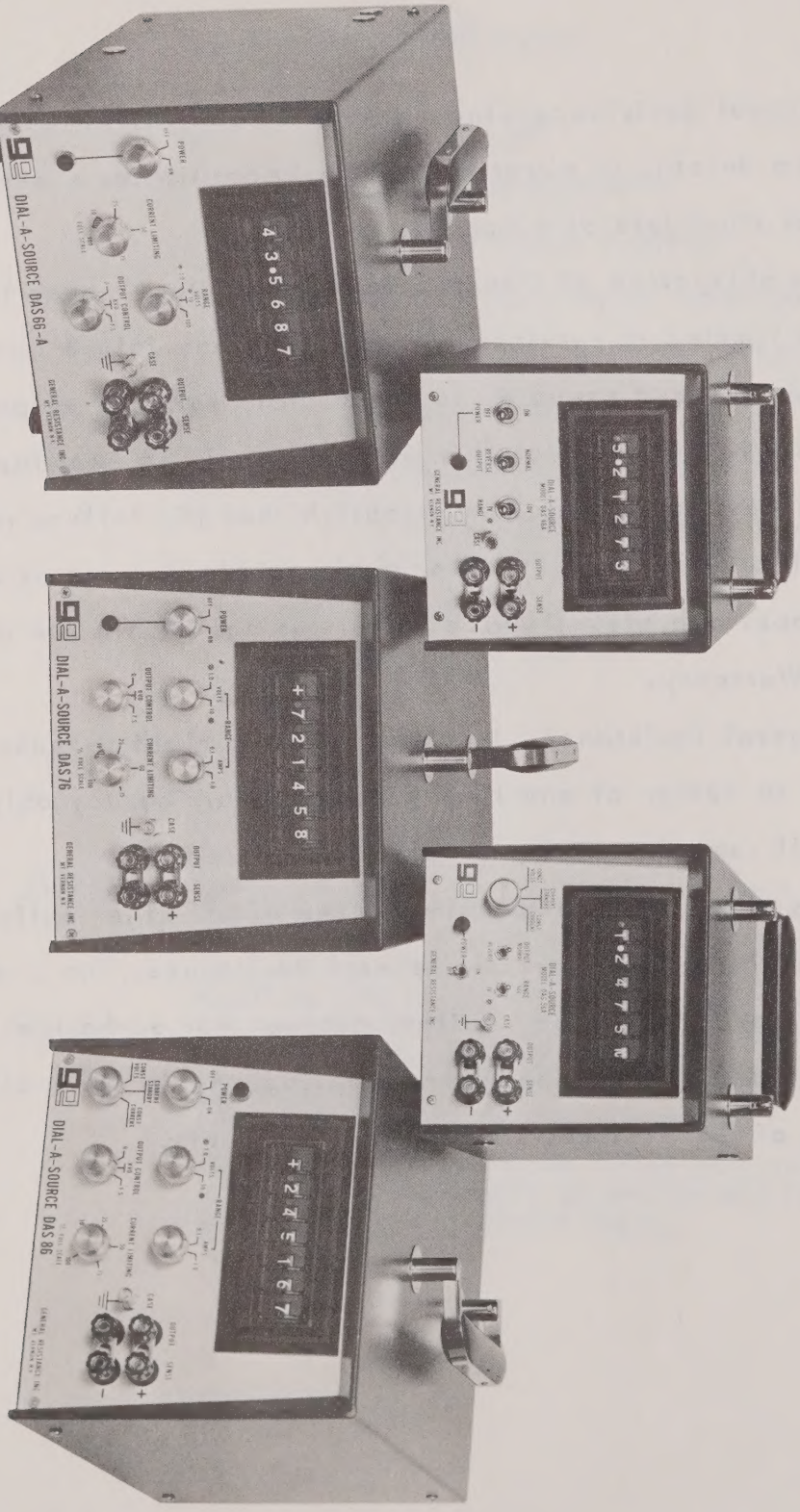
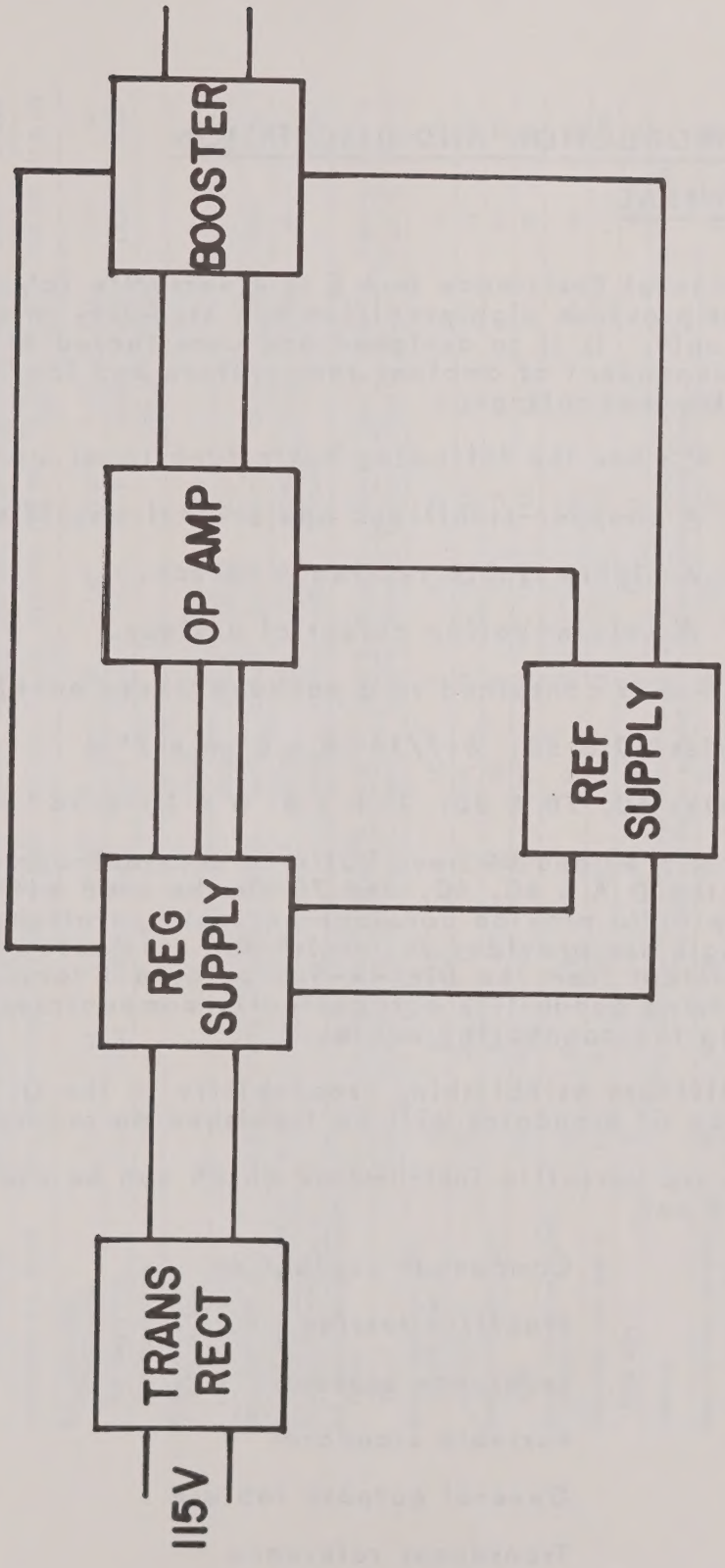


Figure B



SYSTEM BLOCK DIAGRAM

1.0 INTRODUCTION AND DESCRIPTION

1.1 GENERAL

The General Resistance D A S is a versatile laboratory instrument that provides high precision and stability in a compact portable unit. It is so designed and constructed as to be essentially independent of ambient temperature and loading within the instrument ratings.

The D A S has the following basic functional modules:

1. A chopper-stabilized operational amplifier.
2. A highly stable reference source.
3. A Kelvin-Varley potential divider.

The D A S is contained in a package whose envelope is:

Series 40 & 50: 6-7/16" h x 6" w x 7" d

Series 60, 70 & 80: 7" h x 8" w x 10-5/16" d

The D A S 50 and 80 have built-in constant-current operation while the D A S 40, 60, and 70 can be used with an inexpensive adaptor to provide constant-current operation. Remote sensing terminals are provided to furnish the calibrated voltage at locations distant from the Dial-A-Source output terminals. The remote sensing capability automatically compensates for the voltage drop in the connecting cables.

A certificate establishing traceability to the U.S. National Bureau of Standards will be furnished on request.

D A S are versatile instruments which can be used in applications such as:

Component evaluation

Stability testing

Reference sources

Portable standards

General purpose lab use

Transducer reference

Instrument calibration

SPECIFICATION	MODEL NUMBERS											
	DAS-46A	DAS-46AX	DAS-46AL	DAS-47AL	DAS-56A	DAS-56AX	DAS-56AL	DAS-57AL	DAS-66A	DAS-66AX	DAS-76	DAS-86
Output EMF, F.S., ranges	1V & 10V	1V & 10V	1V & 10V	1V & 10V	1V & 10V	1V & 10V	1V & 10V	1V & 10V	1V, 10V, 100V	1V, 10V, 100V	1V & 10V	1V & 10V
Resolution, EMF												
1V Range/Step	1 μV	1 μV	1 μV	0.1 μV	1 μV	1 μV	1 μV	0.1 μV	1 μV	1 μV	1 μV	1 μV
10V Range/Step	10 μV	10 μV	10 μV	1 μV	10 μV	10 μV	10 μV	1 μV	10 μV	10 μV	10 μV	10 μV
100V Range/Step									100 μV	100 μV		
Resolution, Current												
1V Range/Step					10 nA	10 nA	10 nA	1 nA				10 μA
10V Range/Step					100 nA	100 nA	100 nA	10 nA				100 μA
Accuracy(1), EMF, %, ±	0.005	0.0025	0.0015	0.0015	0.005	0.0025	0.0015	0.0015	0.005	0.0025	0.005	0.005
Output Current, max. load ±	30 mA	30 mA	30 mA	30 mA	30 mA	30 mA	30 mA	30 mA	30 mA	30 mA	1A	1A
Accuracy(2), Current, %, ±					0.008	0.0055	0.0045	0.0045				0.008
T.C., Output EMF (20°C-45°C)												
Typical, ±	2 ppm/°C	1 ppm/°C	0.7 ppm/°C	0.7 ppm/°C	2 ppm/°C	1 ppm/°C	0.7 ppm/°C	0.7 ppm/°C	2 ppm/°C	1 ppm/°C	2 ppm/°C	2 ppm/°C
Max., ±	5 ppm/°C	2 ppm/°C	1.5 ppm/°C	1.5 ppm/°C	5 ppm/°C	2 ppm/°C	1.5 ppm/°C	1.5 ppm/°C	5 ppm/°C	2 ppm/°C	5 ppm/°C	5 ppm/°C
Output Stability(3), EMF, ppm/24 hours, ±	10	7	5	5	10	7	5	5	10	7	10	10
ppm/year, ±	25	20	15	15	25	20	15	15	25	20	25	25
Noise and Ripple(4), ppm	10	3	2	2	10	3	2	2	10	3	10	10
or μV	30	20	15	15	30	20	15	15	30	20	30	30
Output Impedance, typical, DC, μohms	50	50	50	50	50	50	50	50	50	50	50	50
Regulation, Line, ppm ±	1.0	0.5	0.5	0.5	1.0	0.5	0.5	0.5	1.0	0.5	1.0	1.0
Load, ppm ±	1	1	1	1	1	1	1	1	1	1	1	1
Isolation	Floating output. Either terminal may be grounded. Leakage typically 10^4 megohms @ 25°C, 50% relative humidity. Either terminal may be guarded up to 500 volts w/respect to ground.											
Warm Up Time, Operating, sec	90	90	90	90	90	90	90	90	90	90	90	90
Max. Stability, min	30-60	30-60	30-60	30-60	30-60	30-60	30-60	30-60	30-60	30-60	30-60	30-60
Dimensions, inches	Portable Models: 6 7/16" h x 6" wd x 7" d; wgt. 10 lbs. except DAS-66A, DAS-66AX, DAS-76, DAS-86: 7" h x 8" w x 10 5/16"d; weight 18 lbs. Rack Models available w/Adaptor.											

(1) of actual setting, +5 μV max. thermally induced error, @ 25°C, nom. line voltage, no load, after warm up.
(2) of actual setting, @ 25°C, nominal line voltage, after warm up.
(3) after 30 minutes warm up; at constant room temperature.
(4) whichever (ppm or μV) is greater. Exclusive of random transients.

2.0 INITIAL SET-UP

2.1 UNPACKING AND INSPECTION

On receipt of unit

1. Check all switches for proper operation, i.e., thumb wheels should have good detent action and no broken tabs. Rotary switch positions should match the panel markings.
2. Perform "Operational check" of Section 4.2.

2.2 INITIAL TURN-ON

The D A S instrument has been checked and calibrated at the factory. However, an operational check should be performed at initial turn-on.

Operating instructions are given in section 3 while the calibration procedure is given in Section 4.3.

Figure C-1

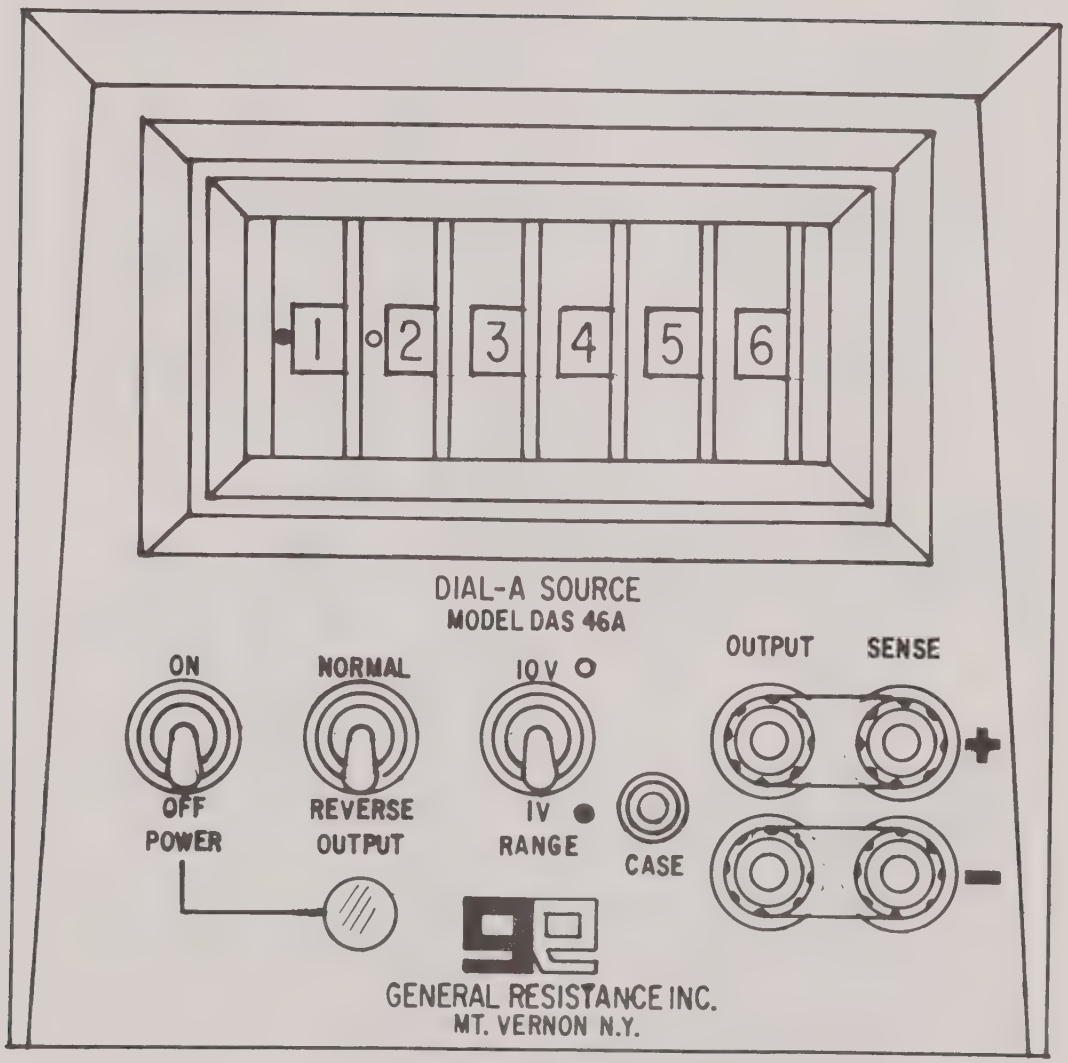

1
2
3
4
5
6
DIAL-A SOURCE
MODEL DAS 46A
ON
OFF
POWER
NORMAL
REVERSE
OUTPUT
10V
1V
RANGE
CASE
OUTPUT
SENSE
+
-
GENERAL RESISTANCE INC.
MT. VERNON N.Y.

Figure C-2

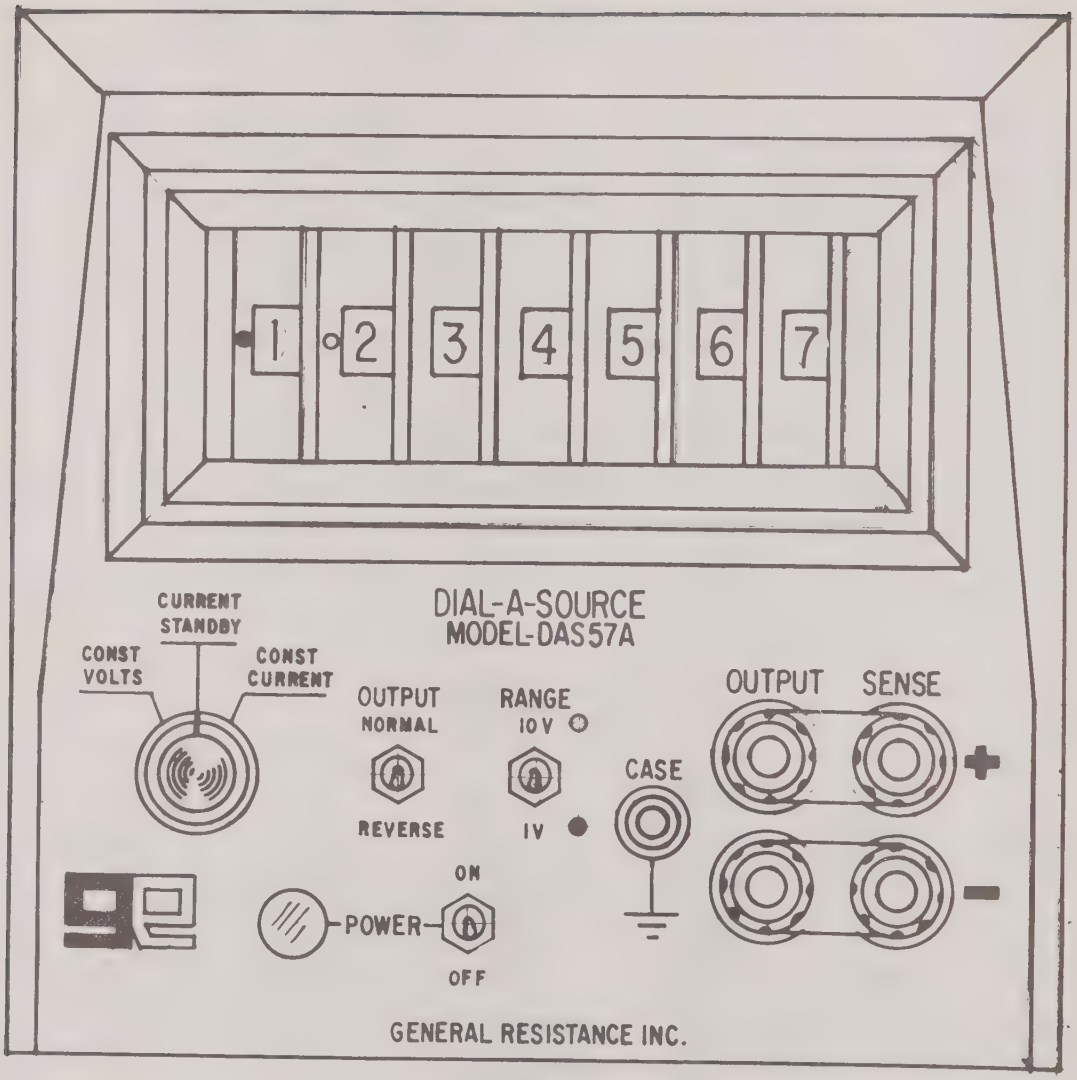
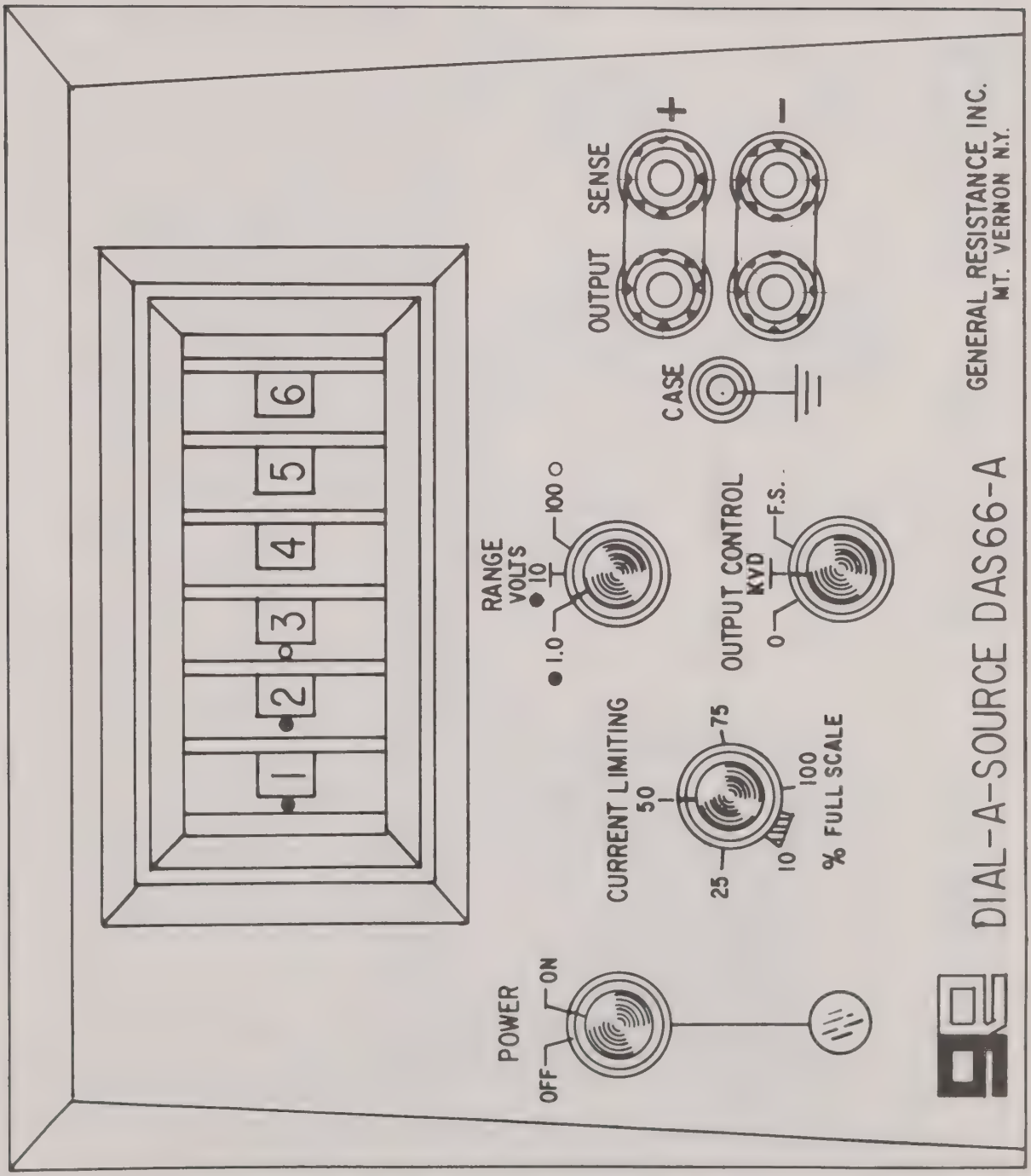

1
2
3
4
5
6
7
DIAL-A-SOURCE
MODEL-DAS57A
CURRENT
STANDBY
CONST
VOLTS
CONST
CURRENT
OUTPUT
NORMAL
REVERSE
RANGE
10V
1V
CASE
OUTPUT
SENSE
+
-
ON
POWER
OFF
GENERAL RESISTANCE INC.

Figure C-3


DIAL-A-SOURCE DAS66-A
GENERAL RESISTANCE INC.
MT. VERNON N.Y.
OUTPUT SENSE
+
-
CASE
RANGE VOLTS
10
100
1.0
CURRENT LIMITING
50
75
25
100
10
% FULL SCALE
OUTPUT CONTROL
KVD
F.S.
0
POWER
ON
OFF
1
2
3
4
5
6

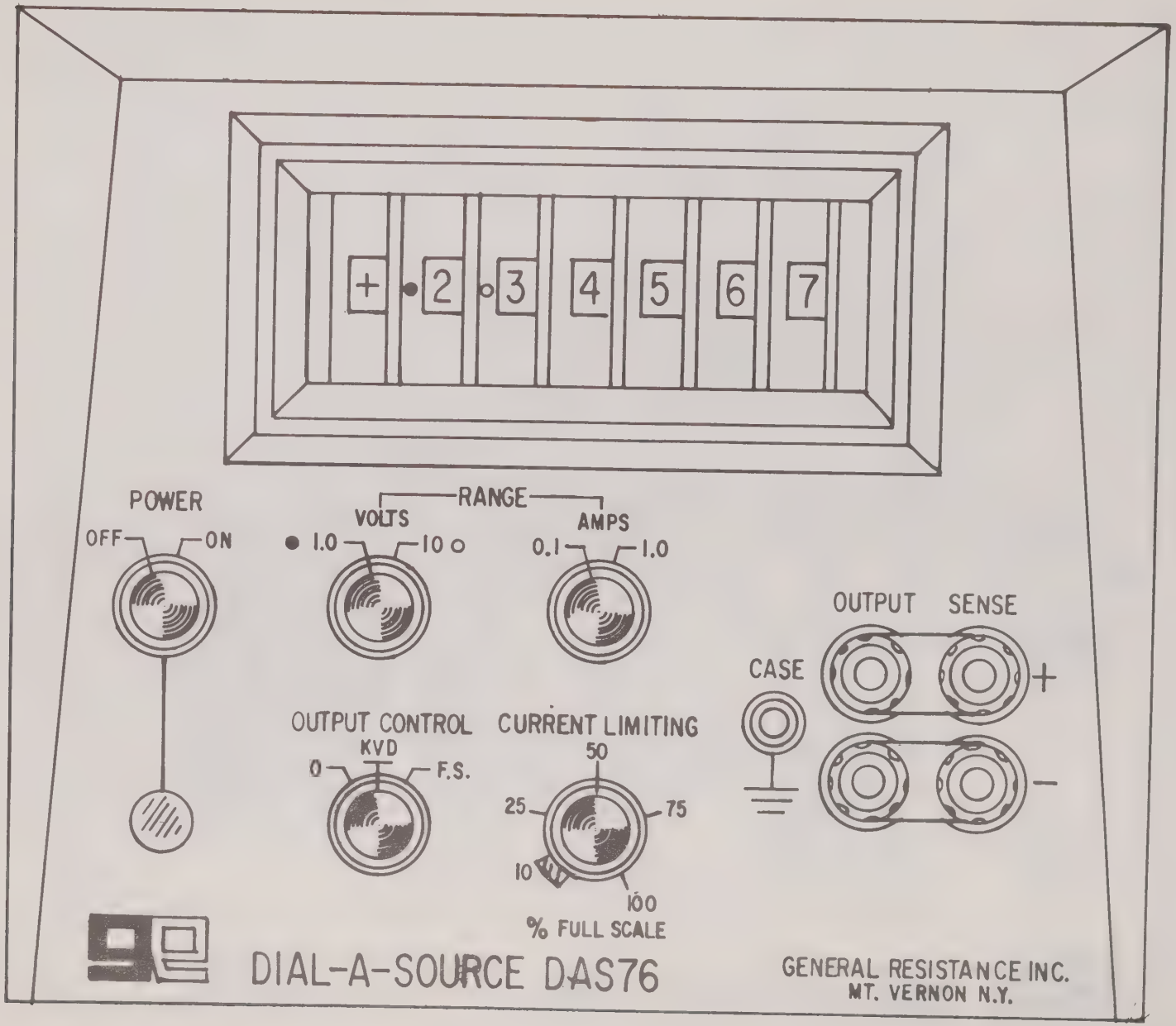

+
2
3
4
5
6
7
POWER
OFF
ON
RANGE
VOLTS
1.0
10
AMPS
0.1
1.0
OUTPUT
SENSE
CASE
+
−
OUTPUT CONTROL
KVD
0
F.S.
CURRENT LIMITING
50
25
75
10
100
% FULL SCALE
DIAL-A-SOURCE DAS76
GENERAL RESISTANCE INC.
MT. VERNON N.Y.

Figure C-4

Figure C-5

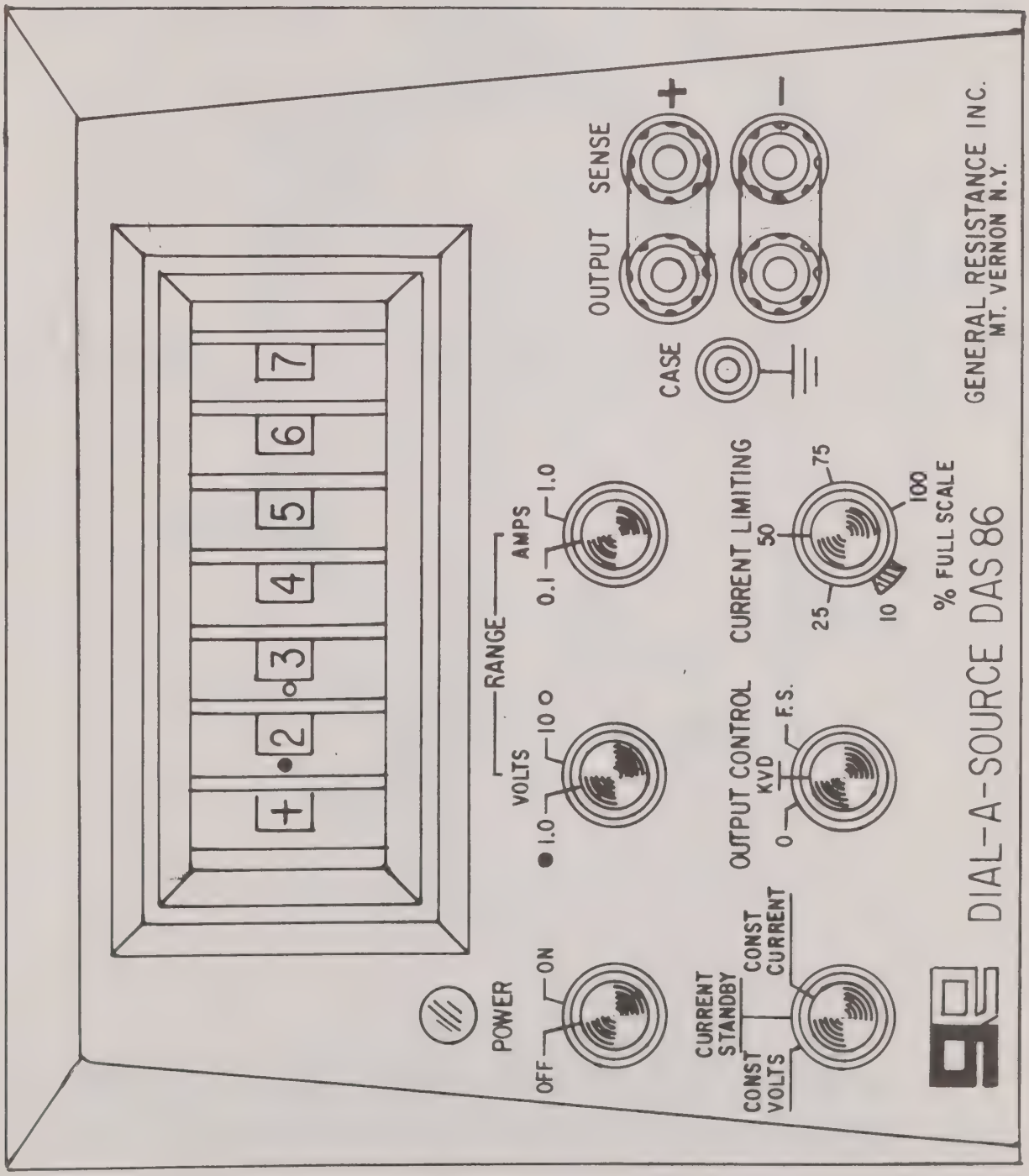
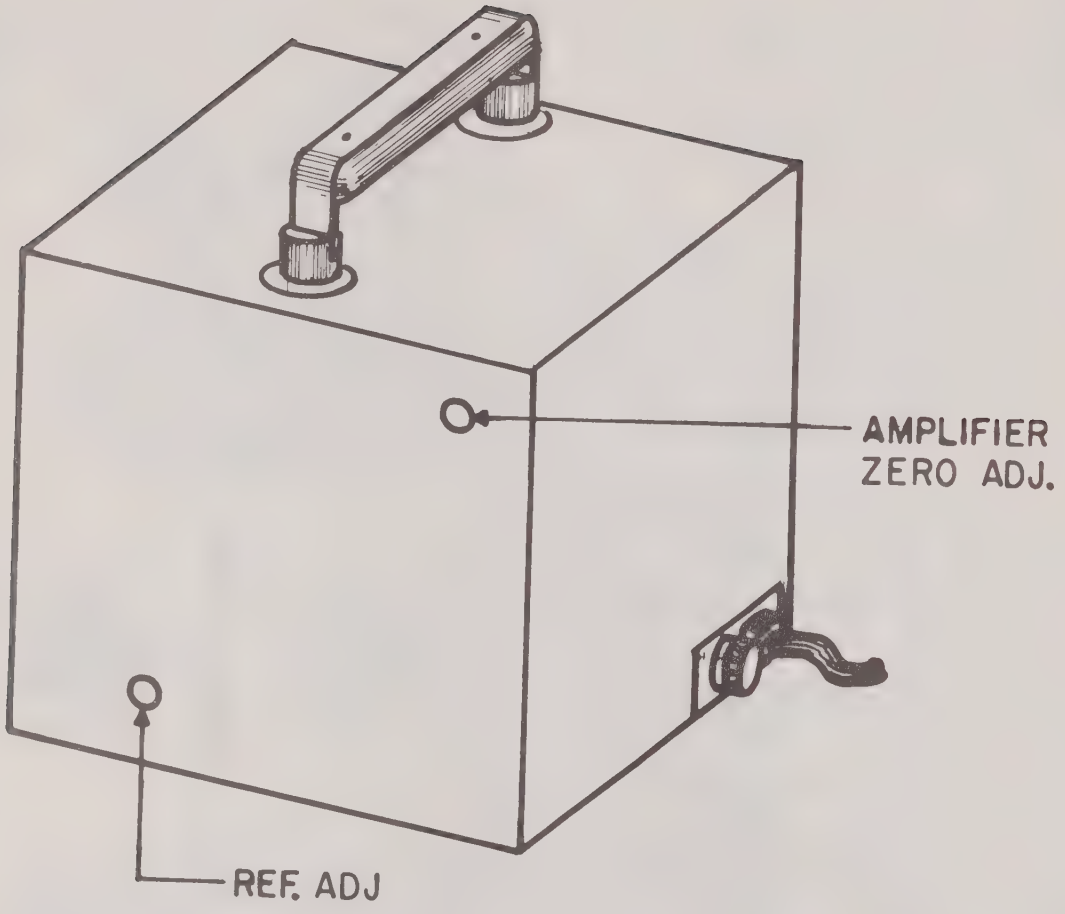
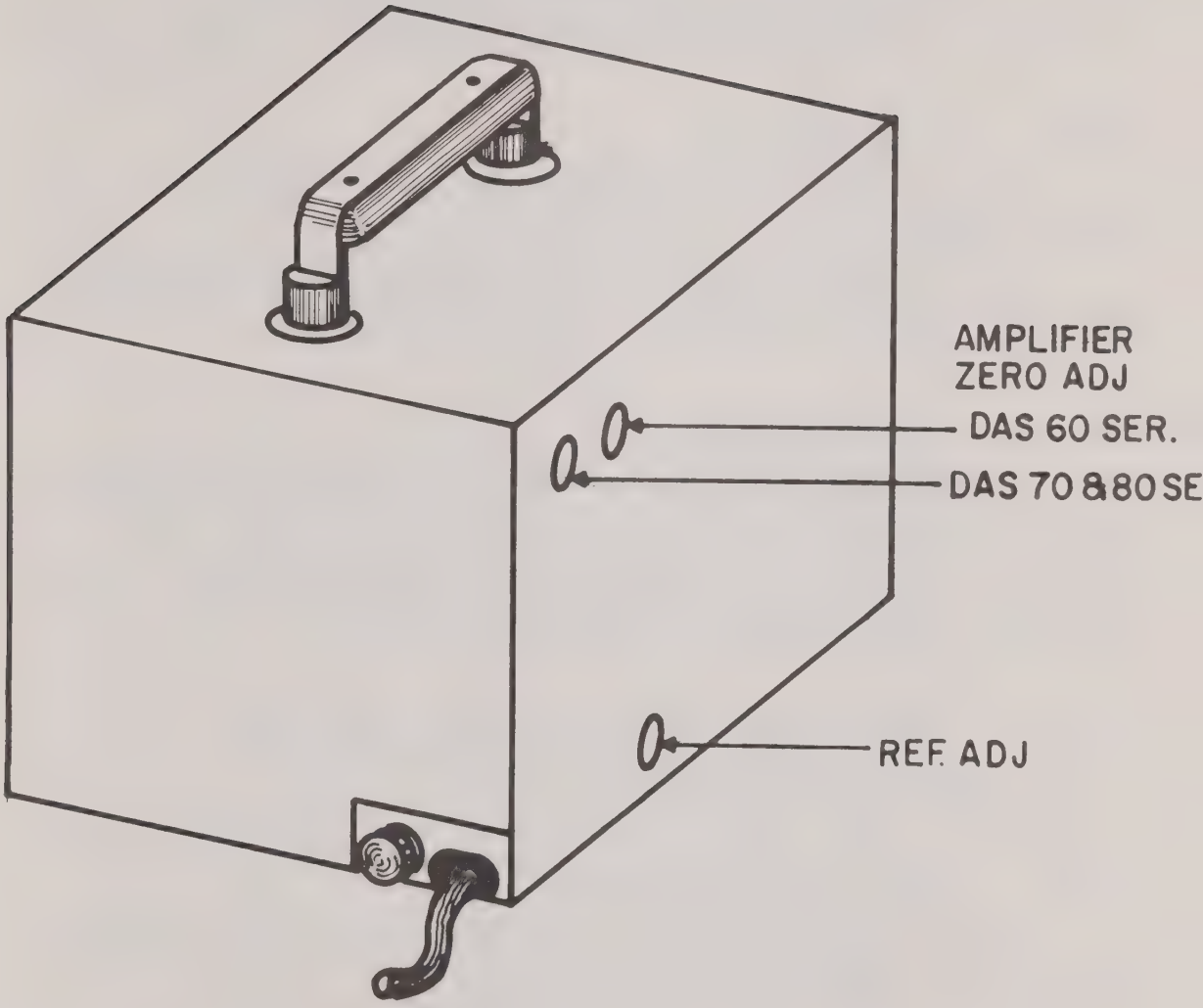

DIAL-A-SOURCE DAS 86
GENERAL RESISTANCE INC.
MT. VERNON N.Y.
OUTPUT
SENSE
+
−
CASE
POWER
OFF
ON
CURRENT STANDBY
CONST VOLTS
CONST CURRENT
OUTPUT CONTROL
KVD
F.S.
0
CURRENT LIMITING
50
75
25
100
10
% FULL SCALE
RANGE
VOLTS
1.0
10
AMPS
0.1
1.0
1
2
3
4
5
6
7

Figure D-1



CALIBRATION CONTROL LOCATION DAS 40 & 50 SER.

Figure D-2



CALIBRATION CONTROL LOCATION DAS 60, 70 & 80 SER.

3.0 DESCRIPTION OF OPERATING CONTROLS

The D A S's front panel controls are shown in Figure C.

3.0.1 POWER SWITCH

The POWER switch is a two-pole single-throw rotary or toggle switch.

In the ON position, full line voltage is applied to the unit and the pilot lamp is ON. After approximately 90 seconds, the output level is that shown by the decade switches.

3.0.2 RANGE SWITCH

The RANGE switch is a single-pole double-throw switch (triple-throw in 60 Series). It introduces a 10:1 voltage divider (two 10:1 dividers in 60 Series) between the precision voltage source and the Kelvin-Varley Divider without changing the load on the precision source. The switch setting indicates the maximum voltage available at the OUTPUT terminals.

3.0.3 POLARITY SWITCH (except DAS Series 60)

The POLARITY switch performs the function of reversing the output voltage polarity.

3.0.4 VOLTAGE DECADE SWITCHES

The thumb switches set and indicate the output voltage. They are the selectors of a six or seven decade Kelvin-Varley Divider.

The most significant digit switch has stops below zero and above nine. The middle digits have no stops and are labeled from zero through nine, while the least significant digit switch is labeled zero through ten.

3.0.5 OUTPUT FUNCTION SWITCH

On D A S Series 60, 70, and 80 a three-position OUTPUT FUNCTION switch permits the output to be zero (0), the KVD setting, or full scale depending on the switch setting.

3.0.6 CURRENT LIMIT CONTROL

On D A S Series 60, 70, and 80 a current limit control allows output current to be limited as a function of percent (%) of full scale.

3.0.7 CONSTANT-CURRENT SELECTION

D A S Series 40, 60, and 70 can be equipped with an optional DAA adaptor which will allow these units to function exactly as D A S Series 50 and 80 in which constant-current capability is built-in.

3.1 CALIBRATION CONTROLS

Calibration adjustments are made through holes in the case normally covered by snap-in plugs. See Figure D.

3.1.1 REFERENCE CALIBRATION

The calibration adjustment is a detented switch accessible through a hole in the right side of the cover.

3.1.2 AMPLIFIER ZERO ADJUST

The amplifier zero adjust control (see Figure D), is a potentiometer. The control is used to set the amplifier output voltage to zero for zero input.

3.2 OPERATING INSTRUCTIONS

3.2.1 POWER

Connect the power plug to a source of 115 VAC (or 230 VAC if unit is so equipped) at 50/60 Hz, and turn the POWER switch on. Power is indicated by the red light on the front panel.

3.2.2 WARMUP

The Dial-A-Source is ready for use almost immediately after the power is turned ON. Allow a period of 30 to 40 seconds for the amplifier to come out of saturation. The instrument will be within its accuracy specifications 2 to 5 minutes after turn-on in a 25°C environment, although 30 minutes may be required for maximum stability.

3.2.3 RANGE

With the D A S RANGE switch in the 100V position (60 Series only) output voltages from 0-100 volts may be dialed in 100 microvolt steps. With the D A S RANGE switch in the 10V position, output voltages from 0 to 10 volts may be dialed in 10 microvolt steps. For voltages from 0 to 1.0 volt, greater accuracy and resolution (1 uV per step) will be obtained with the RANGE switch in the 1V position. These resolution figures are 0.1 uV per step and 1 uV per step in the 1 and 10 volt ranges using a seven decade D A S.

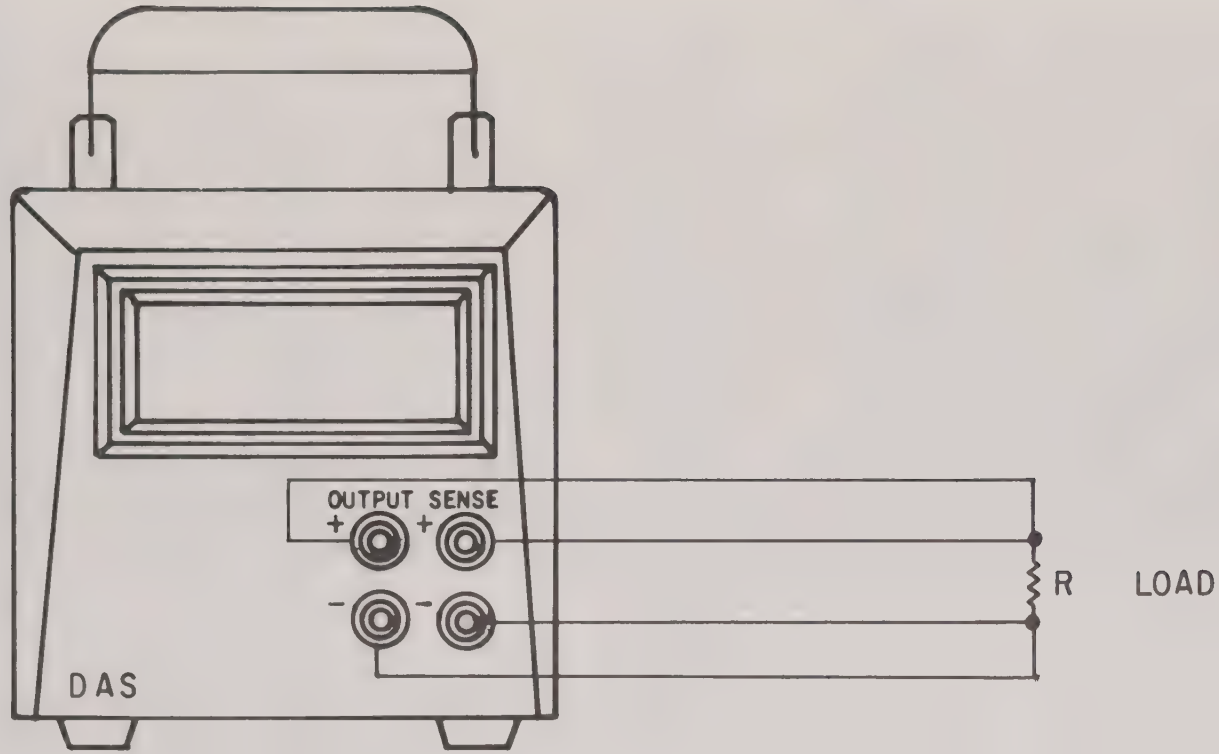
3.2.4 POLARITY

On D A S Series 40, 50, 70, and 80, position the OUTPUT switch to NORMAL (+) if the desired polarity is that indicated by the OUTPUT terminals. For the opposite polarity, throw the OUTPUT switch to REVERSE (-). On D A S 60, if the opposite polarity is desired, reverse output leads.

3.2.5 OUTPUT VOLTAGE

Set the dial switches to read the desired output voltage. On the 100V range (60 Series only) the decimal point is read between the second and third digits. On the 10V range, the decimal point is read between the first and second digits. On the 1V range, it is read before the first digit. These decimal point positions are conveniently color coded. All dials except the first may be continuously rotated in either direction. This permits quicker switching between high and low digits. The first dial has stops at the 0 and 9 positions.

Figure E



1. FOR REMOTE SENSE OPERATION, CONNECT "OUTPUT" AND "SENSE" LINES TOGETHER AT LOAD.
2. FOR VERY LONG DISTANCES, "SENSE" LINES SHOULD BE SHIELDED OR TWISTED FOR LOW NOISE OPERATION.

REMOTE SENSING

3.2.6 REMOTE SENSING

If the load is to be connected through an appreciable resistance such as a long cable, disconnect the shorting links between the OUTPUT and SENSE terminals and connect each of the four terminals to the load by separate wires as in Figure E. The dialed voltage will then appear across the load. The loop resistance of the output leads should be limited to 20 ohms when remote sensing is employed, so that the rated maximum voltage output can be attained. The loop resistance of the output leads for D A S Series 70 and 80 should be less than 1 ohm full load when remote sensing is employed, so that the rated maximum voltage output can be attained. The remote sensing leads may require shielding to prevent hum pickup on the output leads.

CAUTION: When on the 100V range of the 60 Series, disconnecting the shorting links with the unit in operation could result in a swing of output voltage to Full Scale regardless of the KVD setting. To provide for remote sensing on the 100V range, make connections with the unit on the 10V range, or turned off.

3.2.7 LOAD IMPEDANCE LIMITS

To maintain proper operating conditions for the amplifier, the OUTPUT terminals should not be directly loaded with more than 1 uF of capacitance. Shorting the output will not injure the Dial-A-Source, but 60 seconds may be required for it to return to normal operation after the short is removed.

3.2.8 A) CONSTANT CURRENT OPERATION

Constant current on the 50 and 80 Series is achieved as follows:

1) Set the MODE switch to CONSTANT CURRENT STANDBY.

2) Disconnect the shorting links between the OUTPUT and SENSE terminals on the front panel.

3) Insert the load between the +OUTPUT and the + SENSE terminal.

4) Set the desired current with the thumbwheel switches.

a) DAS 50 set range switch to 10V, scale factor is 10mA/V, therefore, with decimal point between the second and third dial, the thumbwheel switches are direct reading in milliamperes.

PLEASE NOTE

On DAS 50's (S/N 200 and up) and on DAS 80's (S/N 120 and up) the following changes are to be made to this instruction manual:

PAGE 21

3.2.8 Constant Current Operation

A)

2) Delete in its entirity

3) Change + Sense to - Output

PAGE 22

3.2.8 Constant Current Operation

A) Continued

Note : First sentence ; change + Sense to - Output

Second sentence; change + Sense to - Output

3.2.8 A) CONSTANT CURRENT OPERATION (continued)

NOTE: With the polarity switch set to NORMAL current flows from the +OUTPUT terminal to the +SENSE terminal. With the POLARITY switch set to REVERSE current flows from the +SENSE terminal to the +OUTPUT terminal.

b) DAS 80 set range switch to 1V, scale factor is 1A/100mV, therefore, with decimal point between first and second dial, the thumbwheel switches are direct reading in amperes. Note from 4a applies.

5) Set MODE switch to CONSTANT CURRENT.

3.2.8 B) Constant current operation on the 40, 60, and 70 Series is achieved as follows:

1) Insert appropriate DAA in the output terminals.

2) Make sure switch on DAA is set to STANDBY.

3) Disconnect the shorting links between the OUTPUT and SENSE terminals on the front panel.

4) Insert load between terminals of DAA.

5) Set the thumbwheel switches per the following table:

SERIES	DAA	RANGE	SCALE FACTOR	POLARITY	DECIMAL POINT LOCATION	UNITS	RESOLUTION 6 DIGIT	RESOLUTION 7 DIGIT
40	40	10V	10mA/V	Select	2nd/3rd	mA	.1 uA	.01 uA
60	60	100V	1 mA/V	see 3.2.4	2nd/3rd	mA	.1 uA	
70	70	1V	1A/100mV	Select	1st/2nd	AMP	10 uA	

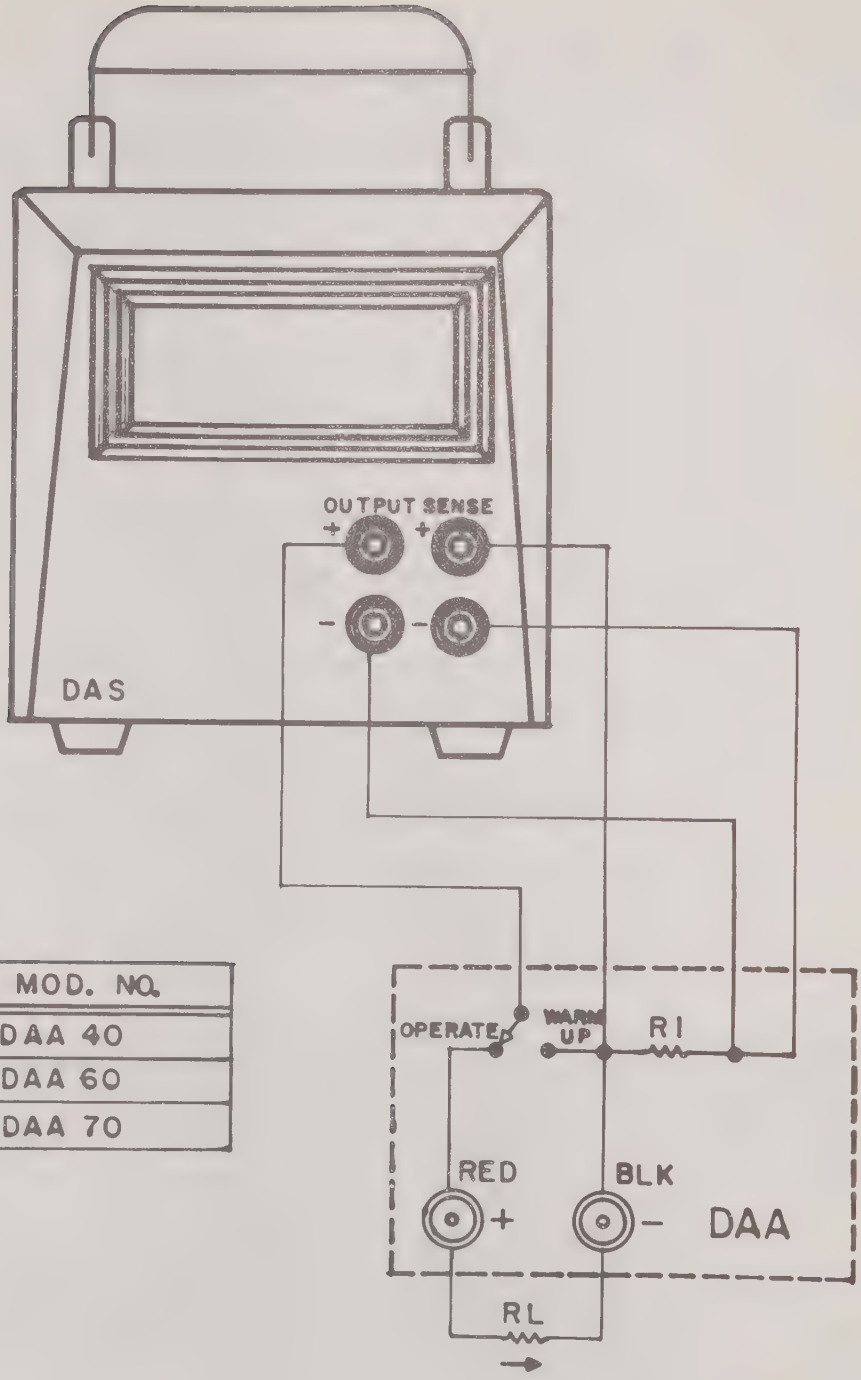
6) Set DAA switch to OPERATE.

7) For the 40 and 70 Series direction of the current flow is determined by the polarity setting of the DAS. Current flows from the + to the - terminal for NORMAL (+) polarity and from - to + for the REVERSE (-) polarity.

8) On the 60 Series current always flows from the + to the - terminal.

NOTE: The 60, 70, and 80 Series also have a current limiting control which is always operational. Therefore when working in the constant current mode the current limiting control should be set at some value slightly above the value of current programmed with the thumbwheel switches.

Figure F



RI	MOD. NO.
100 Ω	DAA 40
1.010 K	DAA 60
.100 Ω	DAA 70

CONSTANT CURRENT SOURCE

3.2.9 CURRENT LIMIT CONTROL

On DAS Series 60, 70, and 80 there is a variable current limit calibrated from zero (0) to one hundred (100) % of full scale, to increase the resolution of this control on DAS Series 70 and 80 there is both a 100 mA and 1 ampere range. (SEE NOTE 8B8). This control is useable for both constant voltage and constant current operation and should be set for a current slightly higher than that required.

3.2.10 OPTIONAL LOW NOISE ATTENUATOR (LNA-100)

The LNA-100 is used with the 40, 50, 60, 70, and 80 Series to attenuate the output voltage set on the thumbwheel switches by a factor of 100. This attenuation is applied to the set voltage and to any offset and drift. This reduces the offset and drift to the nanovolt level (10^{-9} V). The LNA has an output impedance of 10Ω. Care must be taken when using the LNA not to generate any thermal voltages which could exceed the drift, offset, and signal, and destroy the accuracy of the generated voltage at the output terminals of the LNA.

The LNA-100 plugs directly into the output terminals of the DAS 40, 50, 60, 70, and 80 Series. It is not necessary to remove the shorting links on the front panel. The LNA-100 output terminals are switch controlled by a toggle switch on its top. In SHORT position, the output terminals are shorted to establish a reference level for any thermal or extraneous noise. In the OPERATE position, the output at the terminals is the voltage set by thumbwheel switches, RANGE switch, and POLARITY switch, divided by a factor of 100. Its accuracy is ±0.005%.

The LNA-100 is used to provide noise attenuation with great accuracy when the DAS is being used at extremely low output voltage levels where output current is not a consideration.

NOTE: When used on the 60 Series, the instrument must not be used on the 100V range.

4.0 MAINTENANCE AND CALIBRATION

4.1 MAINTENANCE AND REPAIR

The maintenance procedures for DAS are limited to replacement of items that are damaged, broken, or burnt out, such as knobs, pilot lamp or the line fuse.

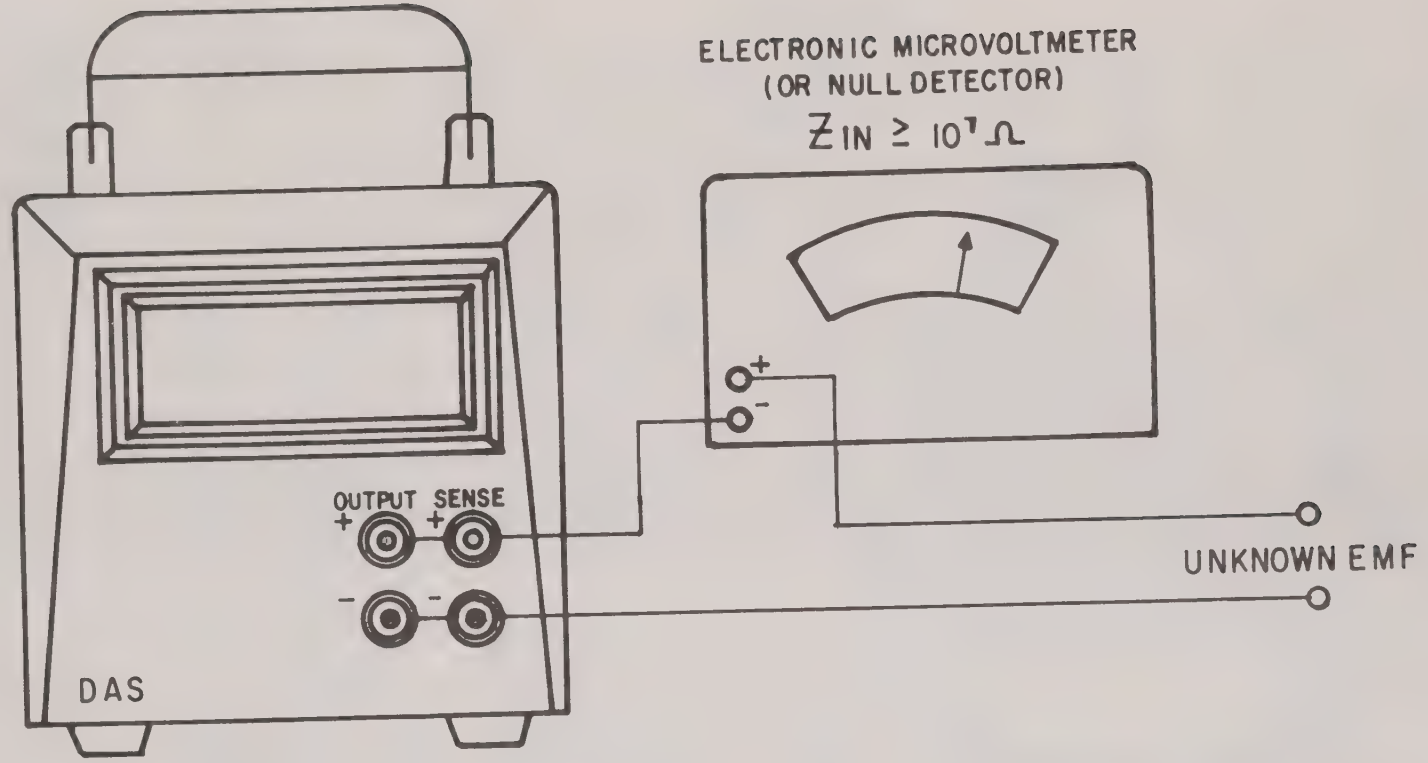
For failures such as standard transistors, capacitors or carbon resistors, regular trouble-shooting and replacement techniques are used. There are no unusual or tricky circuits requiring special analysis or measurement. While ordinary service instruments such as a VOM or a digital DC meter are adequate for general trouble-shooting and repair, the DAS is a very precise instrument that requires precise measurements for its calibration.

The precise output values are dependent upon resistors matched and accurate to better than 0.001%. Should any of these resistors be damaged or over dissipated, the instrument must be returned to the factory.

4.2 OPERATIONAL CHECK

Perform the following operational check before each CALIBRATION.

1. Set all thumb-switches to zero, the RANGE switch to 1 volt. POWER switch OFF.
2. Connect the rated name plate power.
3. Operate the POWER switch and check that the pilot lamp lights.
4. With VOM set to VOLTS, measure zero volts between the output leads.
5. Change POLARITY switch, output remains zero.
6. Set most significant decade switch to 9. Then read 0.9 volts on VOM.
7. Reverse POLARITY switch and meter polarity at same time. Read 0.9 volts on VOM. (Except 60 Series)
8. Set VOM to 10V scale or higher. Set RANGE switch to 10V. Read 9.0 volts on VOM.
9. Reverse POLARITY switch and meter polarity at same time. Read 9.0 volts on VOM.
10. Set all switches to 9 (LSD to 10). Read 10 volts on VOM.

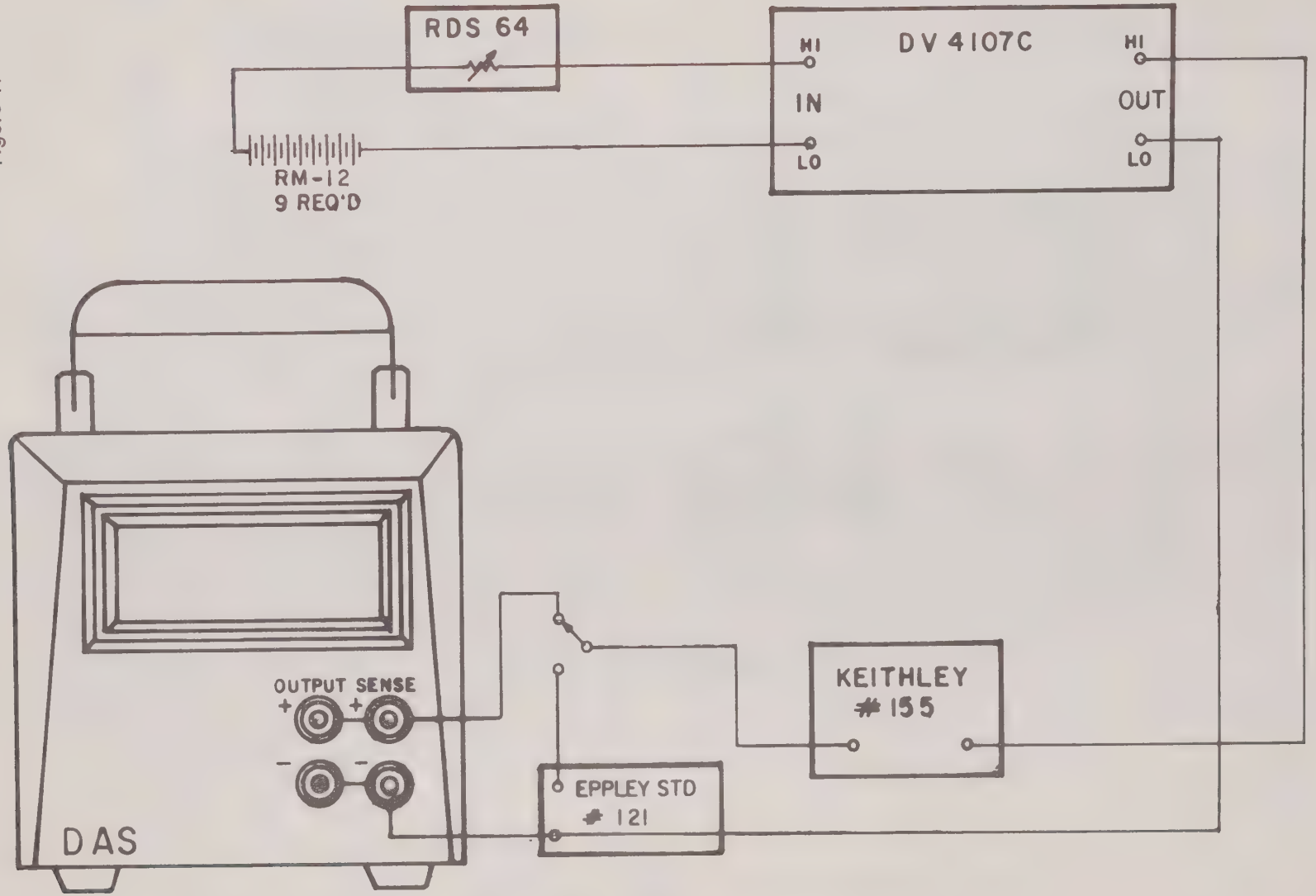


UNKNOWN EMF ≤ 10V

Figure G

DIFFERENTIAL VOLTMETER

Figure H



KELVIN-VARLEY CALIBRATION

4.2 OPERATIONAL CHECK (continued)

THE FOLLOWING STEPS APPLY TO THE 60 SERIES ONLY:

11. Set VOM to 100V scale or higher. Set RANGE switch to 100V. Read 90 volts on VOM.

12. Set all switches to 9 (LSD to 10). Read 100 volts on VOM.

4.3 CALIBRATION

The usual routine maintenance will be the periodic zero setting to the operational amplifier and recalibration of the value of the precision source. General Resistance offers complete calibration at a nominal charge.

4.3.1 AMPLIFIER - ZERO SET

The amplifier zero set should be checked periodically. Annual calibration is adequate for most applications. See Figure D.

PROCEDURE:

1. Set the dials to zero, RANGE switch to 1V, POLARITY switch to "+", allow a 30 minute warm-up time. Measure the output voltage with a micro voltmeter such as the Keithley model 155, or equilavent, set to the 10-0-10 microvolt range. If the reading exceeds ±5 microvolt, the amplifier must be zero set. The microvolt meter is connected across the + and - SENSE terminals.

2. If resetting is indicated, the zero set adjustment is accessible through a hole in the case on the top right side near the back. The hole is normally covered by a snap-in cap. The adjustment is made with a screwdriver until the output is within the range of ±5 microvolts. Replace the cap.

4.3.2 REFERENCE VOLTAGE CALIBRATION

The reference voltage calibration should be checked at least annually. See Figure D.

PROCEDURE:

1. Zero set the amplifier as described in section 4.3.1.

2. Set the dials to zero, the POLARITY to "+", and the RANGE switch to 10V.

PROCEDURE: (continued)

3. Set the dials to the standard cell value. Connect the DAS, microvolt meter and standard cell in a differential voltmeter configuration as shown in Figure G.

4. The meter should read within ± 25 microvolts of zero. If it does not, adjust the 10-step position switch through the hole covered by a snap-in cap near the bottom on the right side. Replace the cap.

4.3.3 CHECK OF KELVIN-VARLEY DIVIDER

The Kelvin-Varley Divider cannot be adjusted but it may be desirable to check one or more decades for accuracy of reading. The procedure is to use a separate 1ppm KVD as a transfer source.

PROCEDURE:

1. Set up the equipment shown in Figure H.

2. Set the external KVD to the value of the standard cell.

3. Adjust the decade box so that the microvolt meter reading is zero. Do not change the decade box setting for the remainder of the tests.

4. Replace the standard cell by the DAS output cables. With the external KVD and that of the DAS under test set to the same reading, the output voltage difference should not exceed the specified accuracy of the DAS ± 10 uV uncertainty of the external 1ppm KVD.

4.3.4 RECOMMENDED TEST EQUIPMENT (or equal)

1. Simpson 260 VOM.

2. Keithley Model 155 microvolt meter.

3. General Resistance Kelvin-Varley Divider, model DV 4107C.

4. Eppley Standard cell # 121.

5. General Resistance Decade Box.

6. 9 each Mallory RM-12 Mercury batteries.

S1 POWER SW. OFF FP ON OFF ON

CM

DIODE BR. CARD 5001-1003

MDA 920A-3 CR-1 · MDA 920A-3 CR-2 · MDA 920A-3 CR-4

C1 .05 MF · C2 .05 MF

115V · 230V · 115V · SH

PWR. SUPPLY ASSY. 5001-1007

HOT · NEUT 115-230V · GND 47-66HZ

F1 1/4A S.B. · L1 56 MH · L2 56 MH · C21 1000 PF 2 · C22 1000 PF · 1000 PF CM

RFI FILTER 5001-1036

DS-1 FP 150K

* MOUNTED ON HEAT SINK
** SELECT AT TEST
F P FRONT PANEL MOUNTED
C M CHASSIS MOUNTED
*** SELECT AFTER BURN IN

◎ PC TERMINAL OR TURRET TYPE TERMINAL
○ EXTERNAL WIRE (SWITCH TERM. CHASSIS MOUNTED LAMP, POT, ETC.)

C1 50MF

R2 30K · R4 4.7K · R6 30K · Q3 2N4249 · R43 4.7K · R9 9.1Ω

Q1 · Q2 2N 4249 · C2 .22 MF · R5 33Ω

2N3568 Q4 · R7 5.6K · Q5 2N5294 · R8 470Ω

+15 REG.

C3 10MF · C4 50 MF · R10 3.9K · R11 200Ω · R12 3.9K

Q6 · Q7 2N 3568 · R3 68K

COM.

-15V REG.

C17 .01 MF · R46 100K · C18 .01 MF

TRIM · +15V · IN · CSA · REF · CASE · -15V

5001-1004

C23 1MF · C29 1MF · C28 1MF · R48 51K · R142 51K · R143 2.7Ω

+OUTPUT · +SENSE · -OUTPUT · -SENSE · CASE

C5 50MF

R18 30K · R19 4.7 · R20 30K · Q10 2N4249 · R44 4.7K · R84 9.1

R14 1.5M

Q8 · Q9 2N 4249 · Q11 2N3568 · Q12 2N 5294 · C8 .22 MF · R22 5.6K · R23 470Ω

CR2 IN914 · R21 33 · R16 8.2K

C9 10 MF · R25 5.1K · C10 50MF · R26 500Ω · R27 2.7K

Q13 2N 3568 Q14 · CR1 IN752A · R17 24K

R32 30K · R34 4.7K · R36 30K · Q17 2N4249 · R45 4.7K · R39 16Ω

R29 1.5M

Q15 · Q16 2N 4249 · Q18 2N3568 · Q19 2N5294 · C14 .22 MF · R37 5.6K · R38 470Ω

C11 50MF · CR4 IN 914 · R35 33Ω

R30 ** · R31 16K

C15 10MF · R40 9.1K · R41 2K · C16 50MF · R42 2.7K

Q20 2N 3568 Q21 · CR18 IN752A · R33 24K

P.C CARD ASSY. 5001-1001

OUTPUT S4 REVERSE NORMAL

RANGE S5 10V 1V

REGULATOR ASSY. 5001-1032

R50 2.9K · R53 550Ω · R51 150Ω · R52 100Ω · CR9 *** · CR8 IN827 ***

R49 300Ω

R57 R58 R59 R56 R55 R54 R60 R61 R62 R63

K.V.D SWITCH & 10/1 DIVIDER ASSY. 5050-1036

R66 2 R64 17.6K ** · R66A ** · R65 L.96K · R67 2.438K · R79 **

DECK 1 DECK 2 DECK 3 DECK 4 DECK 5 DECK 5A DECK 6

R 68 R 69 R 70 R 71 R 72 R 73 R 74 R 75 R 76 R 77 R 78 S6

R 81 R 82 R 83 R 84 R 85 R 86 R 87 R 88 R 89 R 90 R 91 S7

R 93 R 94 R 95 2.5K R 96 R 97 R 104 2.5K R 98 R 99 R 100 R 101 R 102 R 103 S8

R 105 R 106 R 107 R 108 R 109 2.5K R 110 R 111 R 112 R 113 R 114 R 115 S9

R 117 R 118 R 119 2.5K R 120 R 121 R 128 2.5K R 122 R 123 R 124 R 125 R 126 R 127 S10

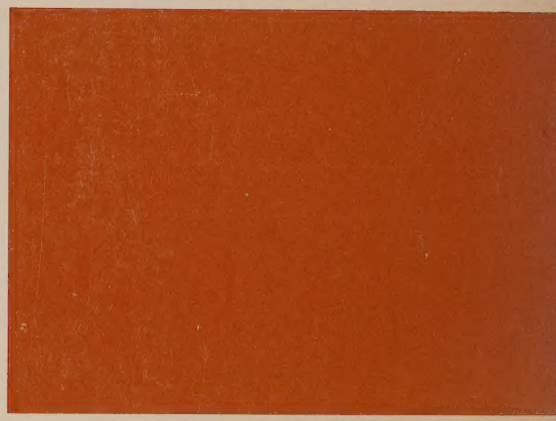
R 139 R 140 R 141 R 150 2.5K R 142 R 143 2.5K R 144 R 145 R 146 R 147 R 148 R 149 S12

R 129 R 130 R 131 R 132 R 133 R 134 R 135 R 136 R 137 R 138 S11

ALL RESISTORS IK UNLESS OTHER-WISE SPECIFIED

FP

MATERIAL					FINISH	TRUE CENTERS WITHIN .003 OF CENTER LINE. TOLERANCES: DECIMALS ±.005 FRACTIONS ±1/64" UNLESS OTHERWISE SPECIFIED.
REVISIONS					GENERAL RESISTANCE INC.	
LETTER NO	E.C.N. NO	DATE	BY	APP	TITLE: DAS 47AL SCHEMATIC	
					DRAWN BY / DATE	E.I.D. NO.
					CHECKED BY / DATE	SCALE
					APPROVED BY / DATE	DRAWING NO. 5011-1000



21-N-2

MP MASTER
MA29508

GENERAL RESISTANCE, INC.

U.S.A.: 500 Nuber Avenue, Mt. Vernon, New York (914) 699-8010 TWX 710 560 0014
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